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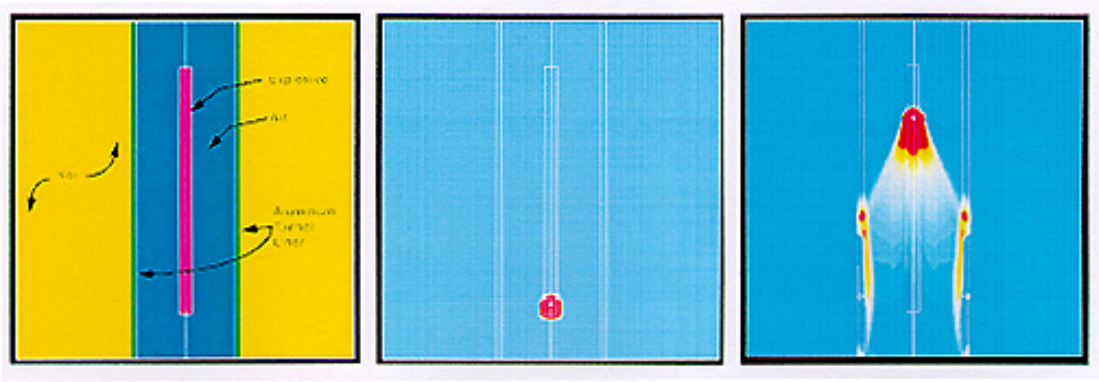
Explosive Structure Interaction

Need

Explosive assault on Federal Facilities, Embassy's and civilian structures is increasingly common in the U.S. Design of public and Government structures to resist blast loading is increasingly important. Classical structural engineering and building codes have never addressed blast loading of public facilities and structures. There is a real need to apply computational capabilities developed at Sandia National Laboratories to aid in understanding the effects of explosives on public facilities. A type of public structure that causes great concern in relation explosive assault are civilian tunnels that carry highways under cities, mountains and waterways. An understanding of the effect of explosives on these facilities can aid public officials in restricting vehicle size in order to control the amount of explosive a tunnel might be exposed to.

Description

Computational capabilities for predicting explosive/structure interaction have been used to study the effects of decoupled explosives in tunnels. This work has application in DOE defense programs in understanding the behavior of buried bunkers and tunnels during explosive assault. It also has applications to Architectural Surety and understanding the effects of malevolent explosive assaults on civilian structures. A calculation has been performed to model an aluminum-lined tunnel buried in soil. Computer modeling of this configuration was done using the Arbitrary Eulerian Lagrangian (ALE) code ALEGRA. This type of simulation can be done on real tunnels to assess the effect of explosives on the tunnel to aid in the design of new tunnels and the management of existing ones. Results from the computer simulations of a decoupled explosive in a buried tunnel are shown below.



Simulation of the interaction of the detonating explosive with the air inside the tunnel, the aluminum liner and the soil surrounding the tunnel. Color represents pressure in the explosive as it detonates and in the air as it is acted upon by the explosive gases. ALE calculations make it possible to treat gases, liquids, and solids in the same calculation.

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